



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to:
2004/00193

September 3, 2004

Mr. Lawrence C. Evans
Chief, Regulatory Branch
Portland District, Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208-2946

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation on the Effects of the Sucker Creek Bank Stabilization Project, Josephine County, Oregon (Corps No.: 200300599)

Dear Mr. Evans:

Enclosed is a biological opinion (Opinion) pursuant to section 7 of the Endangered Species Act (ESA) prepared by NOAA's National Marine Fisheries Service (NOAA Fisheries), on the effects of issuing a permit under section 404 of the Clean Water Act for the proposed Sucker Creek Bank Stabilization Project, in Josephine County, Oregon. In this Opinion, NOAA Fisheries concludes that the proposed action is not likely to jeopardize the continued existence of ESA-listed Southern Oregon/Northern California (SONC) coho salmon (*Oncorhynchus kisutch*), or destroy or adversely modify designated critical habitat. As required by section 7 of the ESA, NOAA Fisheries includes reasonable and prudent measures with non-discretionary terms and conditions that NOAA Fisheries believes are necessary to minimize the impact of incidental take associated with this action.

This document also contains a consultation on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and its implementing regulations (50 C.F.R. Part 600). NOAA Fisheries concludes that the proposed action may adversely affect designated EFH for Pacific salmon. As required by section 305(b)(4)(A) of the MSA, included are conservation recommendations that NOAA Fisheries believes will avoid, minimize, mitigate, or otherwise offset adverse effects on EFH resulting from the proposed action. As described in the enclosed consultation, 305(b)(4)(B) of the MSA requires that a Federal action agency must provide a detailed response in writing within 30 days of receiving an EFH conservation recommendation.



If you have any questions regarding this consultation, please contact Chuck Wheeler, fisheries biologist, in the Southwest Oregon Habitat Branch of the Oregon State Habitat Office at 541.957.3379.

Sincerely,

A handwritten signature in black ink that reads "Michael R Crouse". The signature is written in a cursive style. To the left of the signature, there is a small, faint handwritten mark that appears to be "f.1".

D. Robert Lohn
Regional Administrator

cc: Dominic Yballe, COE

Endangered Species Act - Section 7 Consultation Biological Opinion

&

Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation

Sucker Creek Bank Stabilization Project,
Josephine County, Oregon
(Corps No. 200300599)

Agency: U. S. Army Corps of Engineers

Consultation
Conducted By: NOAA's National Marine Fisheries Service,
Northwest Region

Date Issued: September 3, 2004

for Michael R. Crouse

Issued by: _____
D. Robert Lohn
Regional Administrator

Refer to: 2004/00193

TABLE OF CONTENTS

INTRODUCTION	1
Background	1
Consultation History	1
Proposed Action	1
Description of the Action Area	2
ENDANGERED SPECIES ACT	2
Biological Opinion	2
Biological Information	3
Evaluating Proposed Actions	7
Biological Requirements	7
Environmental Baseline	8
Analysis of Effects	9
Critical Habitat Effects	11
Cumulative Effects	12
Conclusion	13
Incidental Take Statement	13
Amount or Extent of Take	13
Reasonable and Prudent Measures	14
Terms and Conditions	15
MAGNUSON-STEVENSON FISHERY CONSERVATION AND MANAGEMENT ACT	25
Background	25
Identification of EFH	26
Proposed Actions	26
Effects of Proposed Action	26
Conclusion	27
EFH Conservation Recommendations	27
Statutory Response Requirement	27
Supplemental Consultation	27
DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW	27
LITERATURE CITED	29

INTRODUCTION

Background

This document prepared by NOAA's National Marine Fisheries Service (NOAA Fisheries) includes a biological opinion (Opinion) and incidental take statement in accordance with section 7(b) the Endangered Species Act (ESA) of 1973, as amended (16 USC 1531, *et seq.*), and implementing regulations at 50 C.F.R. 402. As a result of an August 6, 2004, decision by the Ninth Circuit Court of Appeals (*GiffordPinchot Task Force et al. v. U.S. Fish and Wildlife Service*), which ruled that the regulatory definition of destruction or adverse modification of critical habitat is flawed, NOAA Fisheries will rely on the ESA statutory requirement, at 16 USC 1536(a)(4), for its critical habitat analysis. The essential fish habitat (EFH) consultation was prepared in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 USC 1801 *et seq.*) and implementing regulations at 50 C.F.R. 600. The administrative record for this consultation is on file at the Southwest Oregon Habitat Branch in Roseburg, Oregon.

Consultation History

On February 25, 2004, NOAA Fisheries received a biological assessment (BA) from the Portland District of the U.S. Army Corps of Engineers (Corps) along with a letter requesting formal consultation on the effects of issuing a permit under section 404 of the Clean Water Act for the proposed Sucker Creek Bank Stabilization Project. The request was made pursuant to sections 7(a)(2) of the Endangered Species Act ESA and 305(b)(2) of the MSA. The proposed action is to stabilize one bank of Sucker Creek beside Holland Loop Road. The Corps concluded that the project is likely to adversely affect Southern Oregon/Northern California (SONC) coho salmon (*Oncorhynchus kisutch*), an ESA-listed species. On June 24, 2003, representatives from NOAA Fisheries, the Oregon Department of Fish and Wildlife (ODFW), and the Corps accompanied Josephine County Public Works on a visit to the site. Several design alternatives were recommended which resulted in the current application.

Proposed Action

The proposed action is the issuance of a Corps permit to Josephine County Public Works to construct bank stabilization within Sucker Creek, a tributary to the Illinois River. The proposed project involves placement of 75 cubic yards of fill along a 125-foot length of embankment below the ordinary high water mark (OHWM) of Sucker Creek. The fill will consist of five pieces of large woody debris, topsoil, and class 700-metric riprap. The upper 2 feet of existing riprap near the Sucker Creek bridge will be removed and replaced with 2 feet of topsoil. Woody vegetation, such as willow stakes and 15 to 20 native conifer trees, will be planted in the topsoil.

The Corps will condition the permit with project design features (PDF) that will be implemented as conservation measures to minimize impacts to SONC coho salmon and their critical habitat. These PDFs are described in the BA, and include:

1. Conducting instream work during the summer low flow period.
2. The worksite will be isolated from the active channel to minimize turbidity. Sediment laden water will be disposed of in an appropriate upland location or treated before discharge back into the active channel.
3. Fish present in the isolation area will be salvaged before construction. Fish salvage operations will be coordinated with ODFW and NOAA Fisheries.
4. A minimum of five pieces of large woody debris (LWD) will be incorporated into the design. The LWD will be a minimum of 12 inches diameter with intact and untrimmed rootwads. The LWD will be oriented in such a manner to encourage interaction with the active channel.
5. A minimum of 2 feet of topsoil will be placed along the full length of the project area. The topsoil will be vegetated during the earliest appropriate planting season after construction is complete. The vegetation will be sufficient in number, spacing, and diversity to provide enhanced riparian functions and values.

Description of the Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area (project area) involved in the proposed action (50 C.F.R. 402.02). The direct effects occur at or beyond the project site based on the potential for upstream or downstream effects (*e.g.* displacement, injury to, or killing of coho salmon) in the action area. Indirect effects may occur at or beyond the project site when the proposed action leads to additional activities that contribute to aquatic habitat degradation. The proposed action will affect the streambank and stream hydraulics, and result in the suspension and dispersal of fine sediments. These effects are expected to be localized due to the small extent of the proposed project and the low volume and velocity of flows during the work period that will limit the amount and distribution of fine sediments. For this consultation, NOAA Fisheries defines the action area as the immediate project site at river mile 4.7 of Sucker Creek, and 300 feet downstream. This action area occurs within Section 28 of Township 39S, Range 7W.

ENDANGERED SPECIES ACT

Biological Opinion

This Opinion presents NOAA Fisheries' review of the status of SONC coho salmon, the condition of designated critical habitat, the environmental baseline for the action area, all the effects of the action as proposed, and cumulative effects. See, 50 C.F.R. 402.14(g). For the jeopardy analysis, NOAA Fisheries analyzes those combined factors to conclude whether the proposed action is likely to appreciably reduce the likelihood of both the survival and recovery

of the affected ESA-listed species. For the critical habitat, Congress said that 'destruction or adverse modification' could occur when sufficient critical habitat is lost so as to threaten a species' recovery even if there remains sufficient critical habitat for the species' survival. If the action under consultation is likely to jeopardize the continued existence of an ESA-listed species, or destroy or adversely modify critical habitat, NOAA Fisheries must identify any reasonable and prudent alternatives for the action that avoid jeopardy or destruction or adverse modification of critical habitat and meet other regulatory requirements. (50 C.F.R. 402.02).

NOAA Fisheries listed SONC coho salmon as threatened under the ESA on May 6, 1997 (62 FR 24588), and interim protective regulations were issued under section 4(d) of the ESA on July 18, 1997 (62 FR 38479). Critical habitat was designated on May 5, 1999 (64 FR 24049), including Sucker Creek. Critical habitat includes all streams accessible to listed coho salmon between Cape Blanco, Oregon, and Punta Gorda, California. The designation includes all waterways, substrates, and adjacent riparian zones below long-standing, naturally-impassable barriers. The adjacent riparian zone is defined based on key riparian functions. These functions are shade, sediment, nutrient/chemical regulation, streambank stability, and input of large woody debris/organic matter.

The objective of this Opinion is to determine whether the proposed action is likely to jeopardize the continued existence of SONC coho salmon or result in destruction or adverse modification of critical habitat. This consultation is conducted pursuant to section 7(a)(2) of the ESA and its implementing regulations, 50 C.F.R. 402.

Biological Information

Coho salmon are known to spawn and rear in Sucker Creek. Adult coho salmon enter Sucker Creek in early November and spawn through January. Coho salmon are distributed throughout the mainstem of Sucker Creek and in most of its tributaries. ODFW has identified the project area as spawning, migration and rearing habitat. ODFW conducted snorkel surveys of Sucker Creek just below the project site on August 19, 2002. They snorkeled 8 pools over 0.24 miles of stream and observed 2,435 juvenile coho salmon.

Coho salmon

Coho salmon is a widespread species of Pacific salmon, occurring in most major river basins around the Pacific Rim from Monterey Bay in California, north to Point Hope, Alaska, through the Aleutians, and from Anadyr River south to Korea and northern Hokkaido, Japan (Laufle *et al.* 1986). From central British Columbia south, the vast majority of coho salmon adults are 3-year-olds, having spent approximately 18 months in freshwater and 18 months in saltwater (Gilbert 1912, Sandercock 1991). The primary exceptions to this pattern are 'jacks,' sexually mature males that return to freshwater to spawn after only 5 to 7 months in the ocean.

With the exception of spawning habitat, which consists of small streams with stable gravels, summer and winter freshwater habitats most preferred by coho salmon consist of quiet areas with low flow, such as backwater pools, beaver ponds, dam pools, and side channels (Reeves *et al.*

1989). Habitats used during winter generally have greater water depth than those used in summer, and also have greater amounts of large woody debris. West Coast coho smolts typically leave freshwater in the spring (April to June) and re-enter freshwater when sexually mature from September to November and spawn from November to December and occasionally into January (Sandercock 1991).

The status of coho salmon for purposes of ESA listings has been reviewed many times, beginning in 1990. The first two reviews occurred in response to petitions to list coho salmon in the Lower Columbia River and Scott and Waddell creeks (central California) under the ESA. The conclusions of these reviews were that NOAA Fisheries could not identify any populations that warranted protection under the ESA in the LCR (Johnson *et al.* 1991), and that Scott and Waddell Creeks' populations were part of a larger, undescribed evolutionarily significant unit (ESU) (Bryant 1994).

A review of West Coast (Washington, Oregon, and California) coho salmon populations began in 1993 in response to several petitions to list numerous coho salmon populations and NOAA Fisheries' own initiative to conduct a coastwide status review of the species. This coastwide review identified six coho salmon ESUs, of which the three southern-most were proposed for listing, two were candidates for listing, and one was deemed 'not warranted' for listing (Weitkamp *et al.* 1995). In October 1996, the BRT updated the status review for the Central California (CC) ESU, and concluded that it was at risk of extinction (NMFS 1996a). In October 1996, NOAA Fisheries listed this ESU as threatened (63 FR 42587).

In December 1996, the BRT updated the status review update for both proposed and candidate coho salmon ESUs (NMFS 1996b). However, because of the scale of the review, comanagers' requests for additional time to comment on the preliminary conclusions, and NOAA Fisheries' legal obligations, the status review was finalized for proposed coho salmon ESUs in 1997 (NMFS 1997), but not for candidate ESUs. In May 1997, NOAA Fisheries listed the SONC coho salmon ESU as threatened, while it announced that listing of the Oregon Coast (OC) ESU was not warranted due to measures in the 'Oregon Coastal Salmon Restoration Initiative' (Oregon Plan 1997, now referred to as the 'Oregon Plan for Salmon and Watersheds'). This finding for OC coho salmon was overturned in August 1998, and the ESU listed as threatened. The coho salmon BRT met in January, March, and April of 2003 to discuss new data received and to determine if the new information warranted any modification of the conclusions of the original BRTs.

SONC coho salmon.

The SONC coho salmon ESU extends from Cape Blanco in southern Oregon to Punta Gorda in northern California (Weitkamp *et al.* 1995). The status of coho salmon coastwide, including the SONC coho ESU, was formally assessed in 1995 (Weitkamp *et al.* 1995). Two subsequent status review updates have been published by NOAA Fisheries, one addressing all West Coast coho salmon ESUs (NMFS 1996b) and a second specifically addressing the OC coho and SONC coho ESUs (NMFS 1997).

In the 1995 status review, the BRT was unanimous in concluding that coho salmon in the SONC coho ESU were not in danger of extinction but were likely to become so in the foreseeable future if present trends continued (Weitkamp *et al.* 1995). In the 1997 status update, estimates of natural population abundance in this ESU were based on very limited information. Favorable indicators included recent increases in abundance in the Rogue River and the presence of natural populations in both large and small basins, factors that may provide some buffer against extinction of the ESU. However, large hatchery programs in the two major basins (Rogue and Klamath/Trinity) raised serious concerns about effects on, and sustainability of, natural populations.

New data on presence/absence in northern California streams that historically supported coho salmon were even more disturbing than earlier results, indicating that a smaller percentage of streams in this ESU contained coho salmon compared to the percentage presence in an earlier study. However, it was unclear whether these new data represented actual trends in local extinctions, or were biased by sampling effort. This new information did not change the BRT's conclusion regarding the status of the SONC coho ESU. Although the Oregon Plan for Salmon and Watersheds (1997) proposals were directed specifically at the Oregon portion of this ESU, the harvest proposal would affect ocean harvest of fish in the California portion as well. The proposed hatchery reforms can be expected to have a positive effect on the status of populations in the Rogue River basin. However, the BRT concluded that these measures would not be sufficient to alter the previous conclusion that the ESU is likely to become endangered in the foreseeable future.

One effect of the Oregon Plan for Salmon and Watersheds (1997) has been increased monitoring of salmon and habitats throughout the Oregon coastal region. Besides continuation of the abundance data series analyzed in the 1997 status update, Oregon has expanded its random survey monitoring to include areas south of Cape Blanco, including monitoring of spawner abundance, juvenile densities, and habitat condition.

New data for the SONC coho salmon ESU includes expansion of presence-absence analyses, a limited analysis of juvenile abundance in the Eel River basin, a few indices of spawner abundance in the Smith, Mad, and Eel River basins, and substantially expanded monitoring of adults, juveniles, and habitat in southern Oregon. None of these data contradict conclusions reached previously by the BRT. Nor do any of recent data (1995 to present) suggest any marked change, either positive or negative, in the abundance or distribution of coho salmon within the SONC coho ESU. Coho salmon populations continued to be depressed relative to historical numbers, and there are strong indications that breeding groups have been lost from a significant percentage of streams within their historical range. Although the 2001 broodyear appears to be one of the strongest of the last decade, it follows a number of relatively weak years. The Rogue River stock is an exception; there has been an average increase in spawners over the last several years, despite two low years (1998, 1999).

Risk factors identified in previous status reviews, including severe declines from historical run sizes, the apparent frequency of local extinctions, long-term trends that are clearly downward,

and degraded freshwater habitat and associated reduction in carrying capacity continue to be of concern to the BRT. Termination of hatchery production of coho salmon at the Mad River and Rowdy Creek facilities has eliminated potential adverse risk associated with hatchery releases from these facilities. Likewise, restrictions on recreational and commercial harvest of coho salmon since 1994 have undoubtedly had a substantial positive impact on coho salmon adult returns to SONC streams. An additional risk factor that has been identified within the SONC coho ESU is predation resulting from the illegal introduction of non-native Sacramento pikeminnow (*Ptychocheilus grandis*) to the Eel River basin (NMFS 1998). Sacramento pikeminnow were introduced to the Eel River via Pillsbury Lake in the early 1980s and have subsequently spread to most areas within the basin. The rapid expansion of pikeminnow populations is believed to have been facilitated by alterations in habitat conditions (particularly increased water temperatures) that favor pikeminnow (Brown *et al.* 1994, NMFS 1998).

The BRT remained concerned about low population abundance throughout the ESU relative to historical numbers and long-term downward trends in abundance; however, the paucity of data on escapement of naturally-produced spawners in most basins continued to hinder assessment of risk. A reliable time series of adult abundance is available only for the Rogue River. These data indicate that long-term (22-year) and short-term (10-year) trends in mean spawner abundance are upward in the Rogue, however, the positive trends reflect effects of reduced harvest (rather than improved freshwater conditions) since trends in pre-harvest recruits are flat. Less reliable indices of spawner abundance in several California populations reveal no apparent trends in some populations and suggest possible continued declines in others.

Additionally, the BRT considered the relatively low occupancy rates of historical coho salmon streams (between 37% and 61% from broodyear 1986 to 2000) as an indication of continued low abundance in the California portion of this ESU. The relatively strong 2001 broodyear, likely the result of favorable conditions in both freshwater and marine environments, was viewed as a positive sign, but was a single strong year following more than a decade of generally poor years.

The moderate risk matrix scores for spatial structure reflected a balancing of several factors. On the negative side was the modest percentage of historical streams still occupied by coho salmon (suggestive of local extirpations or depressed populations). The BRT also remains concerned about the possibility that losses of local populations have been masked in basins with high hatchery output, including the Trinity, Klamath, and Rogue systems. The extent to which strays from hatcheries in these systems are contributing to natural production remains uncertain; however, it is generally believed that hatchery fish and progeny of hatchery fish constitute the majority of production in the Trinity River, and may be a significant concern in parts of the Klamath and Rogue systems as well. On the positive side, extant populations can still be found in all major river basins within the ESU. Additionally, the relatively high occupancy rate of historical streams observed in broodyear 2001 suggests that much habitat remains accessible to coho salmon. The BRT's concern for the large number of hatchery fish in the Rogue, Klamath, and Trinity systems was also evident in the moderate risk rating for diversity.

A majority (67%) of BRT votes fell into the ‘likely to become endangered’ category, while votes in the ‘endangered’ category outnumbered those in the ‘not warranted’ categories by 2-to-1. The BRT found moderately high risks for abundance and growth rate/production, with mean matrix scores of 3.5 to 3.8, respectively, for these two categories. Risks to spatial structure and diversity were judged by the BRT to be moderate.

Evaluating Proposed Actions

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA as defined by 50 C.F.R. Part 402 (the consultation regulations). NOAA Fisheries must determine whether the action is likely to jeopardize the listed species and/or whether the action is likely to destroy or adversely modify critical habitat. This analysis involves the definition of the biological requirements and current status of the listed species, and evaluation of the relevance of the environmental baseline to the species’ current status.

Subsequently, NOAA Fisheries evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NOAA Fisheries must consider the estimated level of mortality attributable to: (1) Collective effects of the proposed or continuing action; (2) the environmental baseline; and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed salmonid’s life stages that occur beyond the action area. If NOAA Fisheries finds that the action is likely to jeopardize the listed species, NOAA Fisheries must identify reasonable and prudent alternatives for the action.

Furthermore, NOAA Fisheries evaluates whether the action, directly or indirectly, is likely to destroy or adversely modify the listed species’ designated critical habitat. NOAA Fisheries must determine whether habitat modifications appreciably diminish the value of critical habitat for both survival and recovery of the listed species. NOAA Fisheries identifies those effects of the action that impair the function of any essential element of critical habitat. NOAA Fisheries then considers whether such impairment appreciably diminishes the habitat’s value for the species’ survival and recovery. If NOAA Fisheries concludes that the action will destroy or adversely modify critical habitat, it must identify reasonable and prudent alternatives for the action.

For the proposed action, NOAA Fisheries’ jeopardy analysis considers direct or indirect mortality of fish attributable to the action. NOAA Fisheries’ critical habitat analysis considers the extent to which the proposed action impairs the function of essential biological elements necessary for juvenile and adult migration, and juvenile rearing of SONC coho salmon.

Biological Requirements

The first step in the methods NOAA Fisheries uses for applying the ESA section 7(a)(2) to listed coho salmon is to define the species’ biological requirements that are most relevant to each consultation. NOAA Fisheries also considers the current status of the listed species, taking into account population size, trends, distribution, and genetic diversity. To assess the current status

of the listed species, NOAA Fisheries starts with the determinations made in its decision to list SONC coho salmon for ESA protection and also considers new available data that is relevant to the determination.

The relevant biological requirements are those necessary for SONC coho salmon to survive and recover to naturally-reproducing population levels, at which time protection under the ESA would become unnecessary. For this consultation, the biological requirements are improved habitat characteristics that function to support successful juvenile and adult migration and juvenile rearing in the action area.

Environmental Baseline

In step two of NOAA Fisheries' analysis, we evaluate the relevance of the environmental baseline in the action area. Regulations implementing section 7 of the ESA (50 C.F.R. 402.02) define the environmental baseline as the past and present effects of all Federal, state, or private actions and other human activities in the action area. The environmental baseline also includes the anticipated effects of all proposed Federal projects in the action area that have undergone section 7 consultation, and the effects of state and private actions that are contemporaneous with the consultation in progress.

Land uses in the action area include rural and agricultural. Riparian areas and stream channels in the action area have been damaged by development activities related to these land uses (FEMAT 1993, Botkin *et al.* 1995, OCSRI 1997). Habitat changes that have contributed to the decline of SONC coho salmon in the action area include: (1) Reduced biological, chemical, and physical connectivity between streams, riparian areas, floodplains, and uplands; (2) elevated fine sediment yields; (3) reduced instream large woody debris; (4) loss or degradation of riparian vegetation; and (5) altered stream channel morphology (OCSRI 1997).

Agricultural practices in the action area have constrained the stream by directly altering the riparian and floodplain areas to the stream's edge. Riparian vegetation has been removed with the modification of the land surface. The stream channel has been destabilized, increasing the rate of erosion and causing channel down-cutting. In turn, these changes have likely affected surface water flows, erosion potential, flooding and stream migration processes.

Holland Loop Road crosses Sucker Creek on bridge #580065 in the action area. The Sucker Creek channel, which runs east-west in this area, has been gradually moving south and is no longer aligned with the bridge. The stream flows towards the road until it hits the riprap and the other road fill. The stream takes a 90 degree turn to the north where it takes another 90 degree turn to flow under the bridge. The streambanks in this area have experienced significant erosion and have been stabilized near the bridge with riprap as recently as 2002.

Based on the best available information regarding the current status of SONC coho salmon range-wide, the population status, trends, genetics, and the poor environmental baseline conditions within the action area, NOAA Fisheries concludes that the biological requirements of

SONC coho salmon are not currently being met. The degraded habitat, resulting from agricultural practices and road building, indicates many aquatic habitat indicators are not properly functioning within action area. Actions that do not maintain or restore properly functioning aquatic habitat conditions would be likely to jeopardize the continued existence of SONC coho salmon.

Analysis of Effects

The effects analysis presented in this section is based on information in the BA and supplementary material. NOAA Fisheries expects adverse effects to SONC coho salmon to occur from: (1) Turbidity; (2) chemical contamination; (3) loss of habitat function; (4) loss of stream processes; and (5) salvaging operations.

Turbidity

Potential impacts to listed salmon from the proposed action include both direct and indirect effects from turbidity. Potential direct effects include mortality from exposure to turbidity. Also, elevated turbidity may cause behavioral changes (Sigler *et al.* 1984, Berg and Northcote 1985, Whitman *et al.* 1982), during riverbank habitat alterations. Potential indirect effects include alteration of invertebrate communities and adverse affects to primary and secondary productivity (Spence *et al.* 1996). The effects of suspended sediment and turbidity on fish are reported in the literature as ranging from beneficial to detrimental. Turbid conditions have been reported to enhance cover conditions, reduce piscivorous fish/bird predation rates, and improve survival. Elevated turbidity conditions have also been reported to cause physiological stress, reduce growth, and adversely affect survival.

Exposure duration is a critical determinant of the occurrence and magnitude of physical or behavioral effects (Newcombe and MacDonald 1991). Salmonids have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with flood events, and are adapted to such high pulse exposures. Adult and larger juvenile salmonids appear to be little affected by the high concentrations of suspended sediments that occur during storm and snowmelt runoff episodes (Bjornn and Reiser 1991). However, research indicates that chronic exposure can cause physiological stress responses which can increase maintenance energy, and reduce feeding and growth (Redding *et al.* 1987, Lloyd 1987, Servizi and Martens 1991). NOAA Fisheries anticipates that turbidity generated from construction of the proposed project will be limited in time. The work area will be isolated from stream flow during construction and turbid water will be pumped to the upland or treated. The only source of turbidity will occur when the coffer dams are set up and taken down. This is expected to take a few hours within one day.

Behavioral avoidance of turbid waters may be one of the most important effects of suspended sediments (DeVore *et al.* 1980, Birtwell *et al.* 1984, Scannell 1988). Salmonids have been observed to move laterally and downstream to avoid turbid plumes (McLeay *et al.* 1984, 1987, Sigler *et al.* 1984, Lloyd 1987, Scannell 1988, Servizi and Martens 1991). Juvenile salmonids tend to avoid streams that are chronically turbid, such as glacial streams or those disturbed by

human activities, unless the fish need to traverse these streams along migration routes (Lloyd 1987). For the proposed project, NOAA Fisheries expects that some coho salmon juveniles may be harassed by turbidity plumes when the coffer dams are set up and taken down, but should be able to easily avoid them. The probability of injuries to SONC coho salmon are expected to be low because turbidity should be localized (approximately 300 feet).

Chemical Contamination

As with all construction activities, accidental release of fuel, oil, and other contaminants may occur. Operation of back-hoes, excavators, and other equipment requires the use of fuel, lubricants, *etc.*, which, if spilled into the channel of a waterbody or into the adjacent riparian zone, can injure or kill aquatic organisms. Petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, contain poly-cyclic aromatic hydrocarbons (PAHs), which can be acutely toxic to salmonids at high levels of exposure and can also cause chronic lethal and acute and chronic sublethal effects to aquatic organisms (Neff 1985, Hatch and Burton 1999). The potential for a chemical spill with the proposed project is minimal because of the limited area of impact (approximately 150 feet) and the limited time of construction (a few weeks).

Loss of Habitat Function

A comparative review of effects of riprap (Schmetterling 2001) has indicated that salmonid densities at stream locations with riprap banks are reduced as compared to areas with natural banks. This is true even when compared to actively eroding cut banks (Michny and Deibel 1986, Schaffter *et al.* 1983). The use of riprap either results in site characteristics that limit suitability for fish at various life stages (Beamer and Henderson 1998, Peters *et al.* 1998, Li *et al.* 1984, North *et al.* 2002), or perpetuates detrimental conditions that may restrict or limit fish production, such as channelizing the stream (Knudson and Dille 1987). Even when rock may contribute to habitat diversity within the alluvial stream system, habitat complexity is simplified from natural conditions and beneficial biological responses are of limited duration with greater variability (Schmetterling 2001, Beamer and Henderson 1998, Peters *et al.* 1998).

The use of rock riprap effectively changes the localized hydraulics, substrate, and available food and cover for fish at stream sites where it is used. There is an indication that the flow regimes created by rock riprap significantly disrupt juvenile fish. Juvenile fish are associated with lower velocity flows at the streambed interface, holding for food, finding potential hiding places in the gravels, and/or avoiding larger predatory fish in deeper waters. Rock riprap can disrupt flows, reduce food delivery, and create difficult swimming for smaller fish (Michny and Deibel 1986, Schaffter *et al.* 1983).

For the proposed project, 125 feet of streambank will be armored below the OHWM. The loss of habitat function in this area will be minimized by incorporating five pieces of large woody debris into the riprap. Several researchers (Beamer and Henderson 1998, Peters *et al.* 1998, Michny and Deibel 1986, Schaffter *et al.* 1983) found that where large complex wood deposits have been either maintained or incorporated into riprap, fish densities were higher than those without. There will also be riprap removed near the bridge above the high water mark to improve habitat and riparian functions. The stream habitat is also constrained by the presence of Holland Loop

Road. There is no large woody debris and little brush on the streambank of the construction area. Because of this, the project will not result in a significant change in stream habitat.

Loss of Stream Processes

Riprap not only modifies the streambed and streambank habitat, but as its primary purpose, it stops natural stream processes that maintain a functioning stream system. By “fixing” the stream, rock riprap limits habitat formation and transitions that result from dynamic stream processes. Stream migration, channel changes, flooding, ground water interchange, gravel supply, and large wood supply are significant elements of natural stream processes that can be impacted by riprap. It is generally understood that vegetated stream edges, floodplains, and riparian areas contribute to supporting fish and the stream system as a whole.

Stream erosion and adjustments are natural processes for which fish have adapted. Stabilizing banks with rock riprap fixes the stream in place, and limits any adjustment processes and/or formation of natural stream features. Channel migration results in varying water depths, varying size in streambed substrate, and stream habitat features such as small pools and cover from roots or large wood. In-channel structure is formed from deposits of large wood or log jams and roots or fallen trees from riparian area. Juvenile salmon will use these habitats for feeding. Shallow water areas and small structural elements that create localized eddy currents can provide space for juveniles to hide and avoid predation.

The purpose of the proposed action is to stop the natural stream processes over the 125 feet where the riprap will be placed. There will be no opportunity for stream migration, channel changes, gravel supply or large woody debris from the riprapped area. However, the presence of Holland Loop Road will have the same impacts if the proposed project is not implemented. Because of this, the project will not result in a significant change in stream channel processes or potential.

Salvaging Operations

The proposed project will require work area isolation from the flowing water. Because the water will become sediment laden, fish will be salvaged out of the isolation area. All salvage will be in accordance with NOAA Fisheries fish handling guidelines (NOAA Fisheries 1998b). Any listed fish removed from the isolated work areas would experience high stress with the possibility of up to a 5% delayed mortality rate. Based on the average number of juvenile coho salmon present in nearby surveyed pools, it is expected that as many as 305 individuals may be present within the area. The true number may be lower than this since the habitat in the action area is not pool, which is preferred by coho salmon. If coho salmon were not salvaged out of the isolation area, they would likely all perish due to high turbidity and other physical damage.

Critical Habitat Effects

SONC coho salmon critical habitat was designated May 5, 1999 (64 FR 24049). SONC coho salmon critical habitat encompasses accessible reaches of all rivers, including estuarine areas and tributaries, between the Mattole River in California, and the Elk River in Oregon, including all

waterways and substrate below longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for at least several hundred years).

The critical habitat designation focused on essential habitat features which included spawning sites, food resources, water quality, water quantity, and riparian vegetation. The proposed actions have the potential to affect these essential features. Over the short term, temporary disturbances to the aquatic and riparian habitat may occur from the proposed activities. Over the long term, the proposed project will armor 125 feet of streambank below the OHWM. The project will not result in a significant change in stream habitat because the habitat is already constrained by the presence of Holland Loop Road. There is no large woody debris and little brush on the streambank of the construction area. Because of this, the proposed actions are expected to maintain existing environmental baseline conditions as discussed in the Analysis of Effects section. Consequently, NOAA Fisheries does not expect that the net effect of these actions will diminish the conservation value of designated critical habitat for recovery of SONC coho salmon.

Cumulative Effects

Cumulative effects are defined in 50 C.F.R. 402.02 as “those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation.” Other activities within the watershed have the potential to impact fish and habitat within the action area.

NOAA Fisheries is not aware of any specific future non-Federal activities within the action area that would cause greater effects to listed species than presently occurs. The action area includes tracts of private lands. Land use on these non-Federal lands include rural development and agricultural. Chemical fertilizers or pesticides are used on many of these lands, but no specific information is available regarding their use. NOAA Fisheries does not consider the rules governing agricultural practices and rural development on non-Federal lands within Oregon to be sufficiently protective of watershed, riparian, and stream habitat functions to support the survival and recovery of listed species. Therefore, these habitat functions likely are at risk due to future activities on non-Federal forest lands within the basin.

Between 1990 and 2000, the human population in Josephine County increased by 20.9% (U.S. Census Bureau 2004). Thus, NOAA Fisheries assumes that future private and state actions will continue within the action area, increasing as population density rises. As the human population in the county continues to grow, demand for actions similar to the proposed project likely will continue to increase as well. Each subsequent action may have only a small incremental effect, but taken together they may have a significant effect that would further degrade the watershed’s environmental baseline and undermine the improvements in habitat conditions necessary for listed species to survive and recover.

Conclusion

The fourth step in NOAA Fisheries' jeopardy analysis is to decide whether the proposed action, considering the above factors, is likely to appreciably reduce the likelihood of the species' survival and recovery in the wild. After reviewing the current status of SONC coho salmon, the environmental baseline for the action area, the effects of the proposed action and its cumulative effects, NOAA Fisheries has determined that the Sucker Creek Bank Stabilization Project, as proposed, is not likely to jeopardize the continued existence of SONC coho salmon or cause adverse modification or destruction of designated critical habitat. These conclusions were based on the following considerations: (1) The habitat functions and stream processes of the action area are already constrained by the existence of Holland Loop Road, and the project will not further reduce the value to SONC coho salmon; (2) the riprap is limited to 125 linear feet and will not be placed higher than the OHWM; (3) channel migration and other stream processes are constrained behind the riprap; (4) large woody debris will be incorporated into the bank stabilization, which will provide some habitat value; (5) the work site will be isolated from flow, and any turbid water from the work site that escapes into Sucker Creek will be short-term and localized; (6) probability of a chemical spill is low; and (7) an adequate re-vegetation plan will be implemented.

Incidental Take Statement

The ESA at section 9 [16 USC 1538] prohibits take of endangered species. The prohibition of take is extended to threatened anadromous salmonids by section 4(d) rule [50 C.F.R. 223.203]. Take is defined by the statute as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." [16 USC 1532(19)] Harm is defined by regulation as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavior patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering." [50 C.F.R. 222.102] Harass is defined as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering." [50 C.F.R. 17.3] Incidental take is defined as "takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant." [50 C.F.R. 402.02] The ESA at section 7(o)(2) removes the prohibition from any incidental taking that is in compliance with the terms and conditions specified in a section 7(b)(4) incidental take statement [16 USC 1536].

Amount or Extent of Take

NOAA Fisheries anticipates that the habitat-related effects of the proposed action will harass, injure, kill, and harm SONC coho salmon present within the action area as follows. Instream work will temporarily increase sediment, turbidity, and other pollutants in the water. This will cause most fish to avoid the action area, although some juvenile fish are likely be injured or killed because of this exposure due to reduced feeding and growth rates and, ultimately, impaired

juvenile migration and growth to maturity. Further, the project is likely to modify or destroy riparian vegetation, stream banks, and channel conditions that presently provide shade, organic matter contributions, large wood, bank stability, and seasonally suitable microhabitats for holding, feeding, and resting as required for juvenile rearing. Vegetation and stream bank characteristics in the action area will require many years to recover and become favorable for rearing and migration. It is unlikely that habitat conditions below the ordinary high water line where the embankment will be filled with riprap will ever recover preferred habitat characteristics.

Take caused by these habitat-related effects cannot be accurately quantified as a number of fish, in part because the long-term loss of habitat resulting in the injury or death of individuals may be more deleterious than the direct loss of a certain number of individuals. In such circumstances, NOAA Fisheries provides a habitat surrogate to quantify the extent of incidental take. For this project, the extent of take will be limited to the loss of rearing and migration habitat that will occur when riparian, bank and channel habitat functions are displaced or destroyed by a 131-foot long swath of riprap fill placed below ordinary high water.

Further, some juvenile SONC coho salmon are likely to be injured or killed because of capture and release efforts associated with work area isolation. Based on the estimated density of juvenile coho salmon in pools sampled near the action area in 2002, and allowing for up to 5% mortality caused by capture, no more than 305 individuals may be captured to complete this project and no more than 15 juvenile coho salmon may be killed.

Reasonable and Prudent Measures

NOAA Fisheries believes that the following reasonable and prudent measures, are necessary and appropriate to minimize the likelihood of take of ESA-listed fish resulting from implementation of this Opinion. These reasonable and prudent measures will also minimize adverse effects to designated critical habitat. The measures described below are non-discretionary. They must be carried out so that they become binding conditions for the incidental take exemption in section 7(a)(2) to apply. The Corps has the continuing duty to regulate the activities covered in this incidental take statement. If the Corps fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms added to the document authorizing this action, or fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. NOAA Fisheries believes that the following reasonable and prudent measures are necessary and appropriate to minimize the likelihood of take of listed fish resulting from implementation of this Opinion.

The Corps shall:

1. Ensure completion of a comprehensive monitoring and reporting program to confirm that this Opinion is meeting its objective of minimizing take from permitted activities.

2. Avoid or minimize incidental take from construction-related activities by applying conditions that require construction, operation, and maintenance actions with minimum harm to aquatic and riparian systems.
3. Minimize the likelihood of incidental take from in-water work by ensuring that in-water work areas are isolated from flowing water.
4. Minimize the amount and extent of take from loss of instream habitat by implementing measures to minimize impacts to riparian and instream habitat, or where impacts are unavoidable, to replace or restore lost riparian and instream functions.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above for each category of activity.

1. To implement reasonable and prudent measure #1 (monitoring), the Corps shall ensure that:

- a. Salvage notice. The following notice is included as a permit condition.

NOTICE. If a sick, injured or dead specimen of a threatened or endangered species is found, the finder must notify the Roseburg Field Office of NOAA Fisheries Law Enforcement at 541.957.3388. The finder must take care in handling of sick or injured specimens to ensure effective treatment, and in handling dead specimens to preserve biological material in the best possible condition for later analysis of cause of death. The finder also has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not disturbed unnecessarily.

- b. Written planning requirements. Before beginning any work below bankfull elevation,¹ the permittee will provide a copy of the written plans for site restoration, compensatory mitigation, pollution and erosion control, bridge demolition and stormwater management, to the Oregon State Habitat Office of NOAA Fisheries at the following address. Plan requirements are described below.

¹ 'Bankfull elevation' means the bank height inundated by a 1.5 to 2-year average recurrence interval and may be estimated by morphological features such average bank height, scour lines and vegetation limits.

Director, Oregon State Habitat Office
Habitat Conservation Division
National Marine Fisheries Service
Attn: 2004/00193
525 NE Oregon Street
Portland, OR 97232

- c. Implementation monitoring report required. The permittee submits an implementation monitoring report to the Corps and to NOAA Fisheries, at the address above, within 120 days of completing all in-water work. The monitoring report will describe the permittee's success meeting his or her permit conditions.
- d. Implementation monitoring report contents. The monitoring report will include the following information.
 - i. Project identification
 - (1) Permittee name, permit number, and project name.
 - (2) Project location, including any compensatory mitigation site(s), by 6th field HUC and by latitude and longitude as determined from the appropriate USGS 7-minute quadrangle map.
 - (3) Corps contact person.
 - (4) Starting and ending dates for work completed.
 - ii. Habitat conditions. Photos of habitat conditions at the project and any compensation site or sites, before, during, and after project completion.²
 - (1) Include general views and close-ups showing details of the project and project area, including pre and post construction.
 - (2) Label each photo with date, time, project name, photographer's name, and a comment about the subject.
 - iii. Site restoration.
 - (1) The name and address of the party(s) responsible for meeting each component of the site restoration.
 - (2) Performance standards for determining compliance.
 - (3) Any other pertinent requirements such as financial assurances, real estate assurances, monitoring programs, and the provisions for short and long-term maintenance of the restoration.
 - (4) Planting composition and density.
 - (5) A plan to inspect and, if necessary, replace failed plantings for five years.
 - (6) A provision for Corps certification that all action necessary to carry out each component of the restoration is completed, and that the performance standards are achieved.
 - iv. Project data.

² Relevant habitat conditions may include characteristics of channels, eroding and stable streambanks in the project area, riparian vegetation, water quality, flows at base, bankfull and over-bankfull stages, and other visually discernable environmental conditions at the project area, and upstream and downstream from the project.

- (1) Amount of riprap. Record the linear distance of riprap installed.
 - (2) Fish screen. Evidence of compliance with NOAA Fisheries' fish screen criteria (NMFS 1996c).
 - (3) Pollution control. A summary of pollution and erosion control inspections, including any erosion control failure, contaminant release, and correction effort.
 - (4) Isolation of in-water work area, capture and release.
 - (a) Supervisory fish biologist – name and address.
 - (b) Methods of work area isolation and take minimization.
 - (c) Stream conditions before, during and within one week after completion of work area isolation.
 - (d) Means of fish capture.
 - (e) Number of fish captured by species.
 - (f) Release site and condition of all fish released.
 - (g) Any incidence of observed injury or mortality of listed species.
 - (5) Site restoration. Photo or other documentation that site restoration performance standards were met.
 - e. Reinitiation contact. To reinitiate consultation, contact the Oregon State Habitat Office of NOAA Fisheries, at the address above.
2. To implement reasonable and prudent measure #2 (construction-related activities), the Corps shall require the following:
- a. Minimum area. Confine construction impacts to the minimum area necessary to complete the project.
 - b. Preconstruction activity. Complete the following actions before significant³ alteration of the project area.
 - i. Marking. Flag the boundaries of clearing limits associated with site access and construction to prevent ground disturbance of critical riparian vegetation, wetlands and other sensitive sites beyond the flagged boundary. Survey and mark the OHWM at the project site before commencement of work.
 - ii. Emergency erosion controls. Ensure that the following materials for emergency erosion control are onsite.
 - (1) A supply of sediment control materials (*e.g.*, silt fence, straw bales⁴).
 - (2) An oil-absorbing, floating boom.

³ 'Significant' means an effect can be meaningfully measured, detected or evaluated.

⁴ When available, certified weed-free straw or hay bales will be used to prevent introduction of noxious weeds.

- iii. Temporary erosion controls. All temporary erosion controls will be in-place and appropriately installed downslope of project activity within the riparian area until site restoration is complete.
- c. Site preparation. Conserve native materials for site restoration.
 - i. If possible, leave native materials where they are found.
 - ii. If materials are moved, damaged, or destroyed, replace them with a functional equivalent during site restoration.
 - iii. Stockpile any large wood,⁵ native vegetation, weed-free topsoil, and native channel material displaced by construction for use during site restoration.
- d. Earthwork. Complete earthwork (including drilling, excavation, dredging, filling, and compacting) as quickly as possible.
 - i. Site stabilization. Stabilize all disturbed areas, including obliteration of temporary roads, following any break in work unless construction will resume within four days.
 - ii. Source of materials. Obtain boulders, rock, woody materials and other natural construction materials used for the project outside the riparian area.
- e. Cessation of work. Cease project operations under high flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage.
- f. Timing of in-water work. Complete all work below the OHWM between June 15 and September 15, unless otherwise approved in writing by NOAA Fisheries. The applicant shall notify the Corps and NOAA Fisheries at least one week before the start of work below the OHWM.
- g. Fish screens. Install, operate and maintain a fish screen according to NOAA Fisheries' fish screen criteria⁶ on each water intake used for project construction, including pumps used to isolate an in-water work area. Screens for water diversions or intakes that will be used for irrigation, municipal or industrial purposes, or any use besides project construction are not authorized.
- h. Fish passage. Provide passage for any adult or juvenile salmonid species present in the project area during construction, unless otherwise approved in writing by NOAA Fisheries, and after construction for the life of the project.

⁵ For purposes of this Opinion only, 'large wood' means a tree, log, or rootwad big enough to dissipate stream energy associated with high flows, capture bedload, stabilize streambanks, influence channel characteristics, and otherwise support aquatic habitat function, given the slope and bankfull channel width of the stream in which the wood occurs. See, Oregon Department of Forestry and Oregon Department of Fish and Wildlife, *A Guide to Placing Large Wood in Streams*, May 1995 (www.odf.state.or.us/FP/RefLibrary/LargeWoodPlacemntGuide5-95.doc).

⁶ National Marine Fisheries Service, *Juvenile Fish Screen Criteria* (revised February 16, 1995) and *Addendum: Juvenile Fish Screen Criteria for Pump Intakes* (May 9, 1996) (guidelines and criteria for migrant fish passage facilities, and new pump intakes and existing inadequate pump intake screens) (<http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm>).

- i. Pollution and Erosion Control Plan. Prepare and carry out a written pollution and erosion control plan to prevent pollution caused by surveying or construction operations. Submit a copy of the written plan to the Corps and to the Oregon State Habitat Office of NOAA Fisheries, at the address above, before beginning work below bankfull elevation.
 - i. Plan Contents. The pollution and erosion control plan will contain the pertinent elements listed below, and meet requirements of all applicable laws and regulations.
 - (1) The name and address of the party(s) responsible for accomplishment of the pollution and erosion control plan.
 - (2) Practices to prevent erosion and sedimentation associated with access roads, stream crossings, drilling sites, construction sites, borrow pit operations, haul roads, equipment and material storage sites, fueling operations, staging areas, and roads being decommissioned.
 - (3) Practices to confine, remove and dispose of excess concrete, cement, grout, and other mortars or bonding agents, including measures for washout facilities.
 - (4) A description of any regulated or hazardous products or materials that will be used for the project, including procedures for inventory, storage, handling, and monitoring.
 - (5) A spill containment and control plan with notification procedures, specific cleanup and disposal instructions for different products, quick response containment and cleanup measures that will be available on the site, proposed methods for disposal of spilled materials, and employee training for spill containment.
 - (6) Practices to prevent construction debris from dropping into any stream or waterbody, and to remove any material that does drop with minimum disturbance to the streambed and water quality.
 - ii. Inspection of erosion controls. During construction, monitor instream turbidity and inspect all erosion controls weekly, or more often as necessary, to ensure the erosion controls are working adequately.⁷
 - (1) If monitoring or inspection shows that the erosion controls are ineffective, mobilize work crews immediately to make repairs, install replacements, or install additional controls as necessary.
 - (2) Remove sediment from erosion controls once it has reached 1/3 of the exposed height of the control.

⁷ 'Working adequately' means that project activities do not increase ambient stream turbidity by more than 10% above background 100 feet below the discharge, when measured relative to a control point immediately upstream of the turbidity causing activity.

- j. Construction discharge water. Treat all discharge water created by construction (*e.g.*, concrete washout, pumping for work area isolation, vehicle wash water, drilling fluids) as follows.
 - i. Water quality. Design, build and maintain facilities to collect and treat all construction discharge water, including any contaminated water produced by drilling, using the best available technology applicable to site conditions. Provide treatment to remove debris, nutrients, sediment, petroleum hydrocarbons, metals and other pollutants likely to be present.
 - ii. Discharge velocity. If construction discharge water is released using an outfall or diffuser port, velocities may not exceed 4 feet per second, and the maximum size of any aperture may not exceed one inch.
 - iii. Pollutants. Do not release any pollutants including silt, into any wetland.
- k. Heavy Equipment. Restrict use of heavy equipment as follows:
 - i. Choice of equipment. When heavy equipment will be used, the equipment selected will have the least adverse effects on the environment (*e.g.*, minimally-sized, low ground pressure equipment).
 - ii. Vehicle and material staging. Store construction materials, and fuel, operate, maintain and store vehicles as follows:
 - (1) To reduce the staging area and potential for contamination, ensure that only enough supplies and equipment to complete a specific job will be stored on site.
 - (2) Complete vehicle staging, cleaning, maintenance, refueling, and fuel storage in a vehicle staging area placed 150 feet or more from any stream, waterbody, or wetland, unless otherwise approved in writing by NOAA Fisheries, except as stated below.
 - (a) Fuel storage locations within 150 feet of the OHWM shall have containment measures in place that meets or exceeds 100% containment.
 - (b) No auxiliary fuel tanks are stored within 150 feet of the OHWM.
 - (3) Hazardous materials stored within 150 feet of the OHWM shall have containment measures in place that meets or exceeds 100% containment.
 - (4) Inspect all vehicles operated within 150 feet of any stream, waterbody or wetland daily for fluid leaks before leaving the vehicle staging area. Repair any leaks detected in the vehicle staging area before the vehicle resumes operation. Document inspections in a record that is available for review on request by the Corps or NOAA Fisheries.
 - (5) Before operations begin and as often as necessary during operation, steam clean all equipment that will be used below bankfull elevation until all visible external oil, grease, mud, and other visible contaminants are removed.

- (6) Diaper all stationary power equipment (*e.g.*, generators, cranes, stationary drilling equipment) operated within 150 feet of any stream, waterbody or wetland to prevent leaks, unless suitable containment is provided to prevent potential spills from entering any stream or waterbody.
- i. Site restoration. Prepare and carry out a written site restoration plan as necessary to ensure that all streambanks, soils and vegetation disturbed by the project are cleaned up and restored as follows. Submit a copy of the written site restoration plan to the Corps and to the Oregon State Habitat Office of NOAA Fisheries, at the address above, before beginning work below bankfull elevation.
 - i. General considerations.
 - (1) Restoration goal. The goal of site restoration is renewal of habitat access, water quality, production of habitat elements (*e.g.*, large woody debris), channel conditions, flows, watershed conditions and other ecosystem processes that form and maintain productive fish habitats.
 - (2) Streambank shaping. Restore damaged streambanks to a natural slope, pattern and profile suitable for establishment of permanent woody vegetation, unless precluded by pre-project conditions (*e.g.*, Holland Loop Road).
 - (3) Revegetation. Replant area requiring revegetation before the first April 15 following construction. Use a diverse assemblage of species native to the project area or region, including grasses, forbs, shrubs and trees. Noxious or invasive species may not be used.
 - (4) Pesticides. Take of ESA-listed species caused by any aspect of pesticide use is not included in the exemption to the ESA take prohibitions provided by this incidental take statement. Pesticide use must be evaluated in an individual consultation, although mechanical or other methods may be used to control weeds and unwanted vegetation.
 - (5) Fertilizer. Do not apply surface fertilizer within 50 feet of any stream channel.
 - (6) Fencing. Install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
 - ii. Plan contents. Include each of the following elements.
 - (1) Baseline information. This information may be obtained from existing sources (*e.g.*, land use plans, watershed analyses, subbasin plans), where available.
 - (a) A functional assessment of adverse effects, *i.e.*, the location, extent and function of the riparian and aquatic resources that will be adversely affected by construction and operation of the project.

- (b) The location and extent of resources surrounding the restoration site, including historic and existing conditions.
- (2) Goals and objectives. Restoration goals and objectives that describe the extent of site restoration necessary to offset adverse effects of the project, by aquatic resource type.
- (3) Performance standards. Use these standards to help design the site restoration plan and to assess whether the restoration goal is met. While no single criterion is sufficient to measure success, the intent is that these features should be present within reasonable limits of natural and management variation.
 - (a) Bare soil spaces are small and well dispersed.
 - (b) Soil movement, such as active rills or gullies and soil deposition around plants or in small basins, is absent or slight and local.
 - (c) If areas with past erosion are present, they are completely stabilized and healed.
 - (d) Plant litter is well distributed and effective in protecting the soil with few or no litter dams present.
 - (e) Native woody and herbaceous vegetation, and germination microsites, are present and well distributed across the site.
 - (f) Vegetation structure is resulting in rooting throughout the available soil profile.
 - (g) Plants have normal, vigorous growth form, and a high probability of remaining vigorous, healthy and dominant over undesired competing vegetation.
 - (h) High impact conditions confined to small areas necessary access or other special management situations.
 - (i) Streambanks have less than 5% exposed soils with margins anchored by deeply rooted vegetation or coarse-grained alluvial debris.
 - (j) Few upland plants are in valley bottom locations, and a continuous corridor of shrubs and trees provide shade for the entire streambank.
- (4) Work plan. Include a written work plan as part of the site restoration plan with sufficient detail to include a description of the following elements, as applicable.
 - (a) Boundaries for the restoration area.
 - (b) Restoration methods, timing, and sequence.
 - (c) Water supply source, if necessary.
 - (d) Woody native vegetation appropriate to the restoration site.⁸ This must be a diverse assemblage of species that are

⁸ Use references sites to select vegetation for the mitigation site whenever feasible. Historic reconstruction, vegetation models, or other ecologically-based methods may also be used as appropriate.

native to the project area or region, including grasses, forbs, shrubs and trees. This may include allowances for natural regeneration from an existing seed bank or planting.

- (e) A plan to control exotic invasive vegetation.
- (f) Elevation(s) and slope(s) of the restoration area to ensure they conform with required elevation and hydrologic requirements of target plant species.
- (g) Geomorphology and habitat features of stream or other open water.
- (h) Site management and maintenance requirements.
- (5) Five-year monitoring and maintenance plan.
 - (a) A written schedule to visit the restoration site annually for 5 years or longer as necessary to confirm that the performance standards are achieved. Despite the initial 5-year planning period, site visits and monitoring will continue from year-to-year until the Corps certifies that site restoration performance standards have been met.
 - (b) During each visit, inspect for and correct any factors that may prevent attainment of performance standards (*e.g.*, low plant survival, invasive species, wildlife damage, drought).
 - (c) Keep a written record to document the date of each visit, site conditions and any corrective actions taken.

3. To implement reasonable and prudent measure #3 (isolation of in-water work area) the Corps shall ensure that:

- a. Work area isolation. During in-water work (work within the OHWM), ensure that the work area is well isolated from the active flowing stream within a coffer dam (constructed of sand bags, sheet pilings, inflatable bags, *etc.*) or similar structure, to minimize the potential for sediment entrainment. After the coffer dam is in place, any fish trapped in the isolation pool will be removed by a permitted ODFW biologist before de-watering, using ODFW-approved methods.
 - i. Coffer dams. All coffer dams will be of sufficient height to not be inundated during high flows.
 - ii. Water intake structures. Any water intake structure authorized under this Opinion must have a fish screen installed, and operated and maintained in accordance with NOAA Fisheries' fish screen criteria (NMFS 1996c).
 - (1) Water pumped from the work isolation area will be discharged into an upland area providing over-ground flow before returning to the creek. Discharge will occur so that it does not cause erosion.
 - (2) Discharges into potential fish spawning areas or areas with submerged vegetation are prohibited.
 - iii. Work Area Isolation. A work area isolation plan must be approved by NOAA Fisheries before in-water work.

iv. Fish Salvage. Before and intermittently during pumping to isolate an in-water work area, attempt to capture and release fish from the isolated area using trapping, seining, electrofishing, or other methods as are prudent to minimize risk of injury.

- (1) The entire capture and release operation must be conducted or supervised by a fishery biologist experienced with work area isolation and competent to ensure the safe handling of all ESA-listed fish.
- (2) Do not use electrofishing if water temperatures exceed 18°C.
- (3) If electrofishing equipment is used to capture fish, comply with NOAA Fisheries' electrofishing guidelines.⁹
- (4) Handle ESA-listed fish with extreme care, keeping fish in water to the maximum extent possible during seining and transfer procedures to prevent the added stress of out-of-water handling.
- (5) Transport fish in aerated buckets or tanks.
- (6) Release fish into a safe release site as quickly as possible, and as near as possible to capture sites.
- (7) Do not transfer ESA-listed fish to anyone except NOAA Fisheries personnel, unless otherwise approved in writing by NOAA Fisheries.
- (8) Obtain all other Federal, state, and local permits necessary to conduct the capture and release activity.
- (9) Allow NOAA Fisheries or its designated representative to accompany the capture team during the capture and release activity, and to inspect the team's capture and release records and facilities.

4. To implement reasonable and prudent measure #4 (minimize loss of instream habitat), the Corps shall ensure that:

- a. The amount of fill within the floodplain will be minimized.
- b. Boundaries of the clearing limits associated with site access and construction will be flagged to prevent ground disturbance of riparian vegetation, wetlands, and other sensitive sites beyond the flagged boundary.
- c. During excavation, native streambed material will be stockpiled out of the two-year floodplain for later use in back-filling the trenches used to construct coffer dams.
- d. Alteration or disturbance of streambanks and existing riparian vegetation will be minimized. Bank protection material shall be placed to maintain normal waterway configuration whenever possible.

⁹ National Marine Fisheries Service, *Backpack Electrofishing Guidelines* (December 1998) (<http://www.nwr.noaa.gov/1salmon/salmesa/pubs/electrog.pdf>).

- e. Measures will be taken to prevent any debris from falling within the boundaries of the OHWM. Any material that falls within this area will be removed in a manner that has a minimum impact to the riparian area, streambed and water quality.

MAGNUSON-STEVENSON FISHERY CONSERVATION AND MANAGEMENT ACT

Background

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-297), requires the inclusion of essential fish habitat (EFH) descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH.

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting the definition of essential fish habitat, “waters” include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate. “Substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities. “Necessary” means the habitat required to support a sustainable fishery and the managed species’ contribution to a healthy ecosystem; and “spawning, breeding, feeding, or growth to maturity” covers a species’ full life cycle (50C.F.R.600.110).

Section 305(b) of the MSA (16 U.S.C. 1855(b)) requires that:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH;
- NOAA Fisheries shall provide conservation recommendations for any Federal or state activity that may adversely affect EFH;
- Federal agencies shall, within 30 days after receiving conservation recommendations from NOAA Fisheries, provide a detailed response in writing to NOAA Fisheries regarding the conservation recommendations. The response shall include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations of NOAA Fisheries, the Federal agency shall explain its reasons for not following the recommendations.

The MSA requires consultation for all actions that may adversely affect EFH, and does not distinguish between actions within EFH and actions outside EFH. Any reasonable attempt to

encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH.

Therefore, EFH consultation with NOAA Fisheries is required by Federal agencies undertaking, permitting or funding activities that may adversely affect EFH, regardless of its location.

Identification of EFH

Pursuant to the MSA, the Pacific Fisheries Management Council (PFMC) has designated EFH for federally-managed fisheries within the waters of Washington, Oregon, and California. Designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km) (PFMC 1998a, 1998b). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other waterbodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC 1999), and longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for several hundred years) (PFMC 1999). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border (PFMC 1999).

Detailed descriptions and identifications of EFH are contained in the fishery management plans for groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), and Pacific salmon (PFMC 1999). Casillas *et al.* (1998) provides additional detail on the groundfish EFH habitat complexes. Assessment of the potential adverse effects to these species' EFH from the proposed action is based, in part, on these descriptions and on information provided by the Corps and the ODFW.

Proposed Actions

The proposed actions are detailed above in this Opinion. The action area is also defined, and includes the construction area at mile 4.7 of Sucker Creek and 300 feet downstream work site. The action area includes habitats that have been designated as EFH for various life-history stages of coho salmon and Chinook salmon (*O. tshawytscha*).

Effects of Proposed Action

As described in detail in the Analysis of Effects section of this Opinion, the proposed action may result in adverse effects to habitat parameters. These adverse effects are:

- Increased turbidity downstream during construction
- Potential of chemical contamination

- Loss of habitat function
- Loss of stream processes

Conclusion

NOAA Fisheries concludes that the proposed action may adversely affect EFH for coho salmon and Chinook salmon.

EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. While NOAA Fisheries understands that the conservation measures described in the BA will be implemented, it does not believe that these measures are sufficient to address the adverse impacts to EFH described above. The reasonable and prudent measures (detailed above) would address the long-term adverse effects this project has on EFH. Accordingly, NOAA Fisheries recommends that the Corps implement these as recommendations to minimize the potential adverse effects to EFH.

Statutory Response Requirement

Pursuant to the MSA (§305(b)(4)(B)) and 50 C.F.R. 600.920(j), Federal agencies are required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

Supplemental Consultation

The Corps must reinitiate EFH consultation with NOAA Fisheries if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 C.F.R. 600.920(k)).

DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) ("Data Quality Act") specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Opinion addresses

these DQA components, documents compliance with the Data Quality Act, and certifies that this Opinion has undergone pre-dissemination review.

Utility: This ESA section 7 consultation on the Sucker Creek Bank Stabilization Project, in Josephine County, Oregon, concluded that the action will not jeopardize the continued existence of SONC coho salmon. Therefore, the Corps may authorize that action. Pursuant to the MSA, NOAA Fisheries provided the Corps with conservation recommendations to conserve EFH.

The intended users of these consultations are the Corps and the applicant. Clients of the Josephine County Public Works and the American public will benefit from the consultation.

Individual copies were provided to the above listed entities. This consultation will be posted on the NOAA Fisheries NW Region web site (<http://www.nwr.noaa.gov>). The format and naming adheres to conventional standards for style.

Integrity: This consultation was completed on a computer system managed by NOAA Fisheries in accordance with relevant information technology security policies and standards set out in Appendix III, "Security of Automated Information Resources," Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

Objectivity:

Information Product Category: Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NOAA Fisheries ESA Consultation Handbook, ESA Regulations, 50 C.F.R. 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 C.F.R. 600.920(j).

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the literature cited section. The analyses in this biological opinion/EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NOAA Fisheries staff with training in ESA and MSA implementation, and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

LITERATURE CITED

- Beamer, E.M., R.A. Henderson. 1998. Juvenile Salmonid Use of Natural and Hydromodified Streambank Habitat in the Mainstem Skagit River, Northwest Washington. Corps of Engineers, Seattle District. Seattle Washington, September 1998.
- Berg, L. and T.G. Northcote. 1985. Changes In Territorial, Gill-Flaring, and Feeding Behavior in Juvenile Coho Salmon (*Oncorhynchus kisutch*) Following Short-Term Pulses of Suspended Sediment. Canadian Journal of Fisheries and Aquatic Sciences 42: 1410-1417.
- Birtwell, I. K., G. F. Hartman, B. Anderson, D. J. McLeay, and J. G. Malick. 1984. A Brief Investigation of Arctic Grayling (*Thymallus arcticus*) and Aquatic Invertebrates in the Minto Creek Drainage, Mayo, Yukon Territory: An Area Subjected to Placer Mining. Canadian Technical Report of Fisheries and Aquatic Sciences 1287.
- Bjornn, T.C., and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. Pages 83-138 in W.R. Meehan, ed. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19:83-138.
- Botkin, D., K. Cummins, T. Dunne, H. Regier, M. Sobel, and L. Talbot. 1995. Status and future of salmon of western Oregon and northern California: findings and options. Report #8. The center for the study of the environment, Santa Barbara, California.
- BRT (Biological Review Team). 2003. Updated Status of Federally Listed ESUs of West Coast Salmon and Steelhead, Part C – Coho salmon. West Coast Biological Review Team, Northwest Fisheries Science Center and Southwest Fisheries Science Center (July 2003). Available online at: <http://www.nwr.noaa.gov/AlseaResponse/20040528/brtusr.html>
- Brown, L. R. and P. B. Moyle. 1991. Status of Coho Salmon in California. Report to the National Marine Fisheries Service, UC Davis, CA.
- Brown, L. R., P. B. Moyle, and R. M. Yoshiyama. 1994. Historical decline and current status of coho salmon in California. North American Journal of Fisheries Management 14: 237-261.
- Bryant, G. J. 1994. Status review of coho salmon in Scott Creek and Waddell Creek, Santa Cruz County, California. National Marine Fisheries Service, Southwest Region, Protected Species Management Division, 102 p. Available from National Marine Fisheries Service, Southwest Region, 501 W. Ocean Blvd., Suite 4200, Long Beach, California 90802.

- Casillas, E., L. Crockett, Y. deReynier, J. Glock, M. Helvey, B. Meyer, C. Schmitt, M. Yoklavich, A. Bailey, B. Chao, B. Johnson, and T. Pepperell,. 1988. Essential Fish Habitat West Coast Groundfish Appendix. National Marine Fisheries Service. Seattle, Washington. 778 p.
- DeVore, P. W., L. T. Brooke, and W. A. Swenson. 1980. "The Effects of Red Clay Turbidity and Sedimentation on Aquatic Life In the Nemadji River System. Impact of Nonpoint Pollution Control on Western Lake Superior." S. C. Andrews, R. G. Christensen, and C. D. Wilson. Washington, D.C., U.S. Environmental Protection Agency. EPA Report 905/9-79-002-B.
- FEMAT (Forest Ecosystem Management Assessment Team). 1993. Forest ecosystem management: an ecological, economic, and social assessment. Report of the Forest Ecosystem Management Assessment Team. U.S. Government Printing Office 1993-793- 071. U.S. Government Printing Office for the U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Land Management, and National Park Service; U.S. Department of Commerce, National Oceanic and Atmospheric Administration and National Marine Fisheries Service; and the U.S. Environmental Protection Agency.
- Gilbert, C. H. 1912. Age at maturity of the Pacific coast salmon of the genus *Oncorhynchus*. Fish Bull., U.S. 32:3-22.
- Gregory, R. S., and C. D. Levings. 1998. "Turbidity Reduces Predation on Migrating Juvenile Pacific Salmon." Transactions of the American Fisheries Society 127: 275-285.
- Gregory, R.S. 1993. Effect of turbidity on the predator avoidance behavior of juvenile Chinook salmon (*Oncorhynchus tshawytscha*). Canadian J. Fish. Aquatic Sciences 50:241-246.
- Hatch, A.C. and G.A. Burton Jr. 1999. Photo-induced toxicity of PAHs to *Hyalella azteca* and *Chironomus tentans*: effects of mixtures and behavior. Environmental Pollution 106(2): 157-167.
- Johnson, O.W., T.A. Flagg, D.J. Maynard, G.B. Milner and F.W. Waknitz. 1991. Status review for the Lower Columbia River coho salmon. NOAA F/NWC-202.
- Knudsen, E. E., and S. J. Dilley. 1987. Effects of Rip-rap Bank Reinforcement on Juvenile Salmonids in Four Western Washington Streams. North American Journal of Fisheries Management 7:351-356.
- Laufle, J. C., G. B. Pauley, and M. F. Shepard. 1986. Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest): coho salmon. U.S. Fish and Wildlife Service Biological Report 82 (11.48), 18 p.

- Li, H. W., C. B. Schreck, and R. A. Tubb. 1984. Comparison of Habitats near Spur Dikes, Continuous Revetments, and Natural Banks for Larval, Juvenile, and Adult Fishes of the Willamette River. Oregon Cooperative Fishery Research Unit Department of Fisheries and Wildlife, Oregon State University. Water Resources Research Institute, Oregon State University, Corvallis, Oregon 1984.
- Lloyd, D. S. 1987. Turbidity as a Water Quality Standard for Salmonid Habitats in Alaska. *North American Journal of Fisheries Management* 7:34-45.
- McLeay, D. J., G. L. Ennis, I. K. Birtwell, and G. F. Hartman. 1984. "Effects On Arctic Grayling (*Thymallus arcticus*) of Prolonged Exposure to Yukon Placer Mining Sediment: A Laboratory Study." Canadian Technical Report of Fisheries and Aquatic Sciences 1241.
- McLeay, D. J., I. K. Birtwell, G. F. Hartman, and G. L. Ennis. 1987. "Responses of Arctic Grayling (*Thymallus arcticus*) To Acute and Prolonged Exposure to Yukon Placer Mining Sediment." *Canadian Journal of Fisheries and Aquatic Sciences* 44: 658-673.
- Michny, F., and R. Deibel. 1986. Sacramento River Chico Landing to Red Bluff Project 1985 Juvenile Salmon Study. US Fish and Wildlife Service Sacramento, California. US Army Corps of Engineers. 1986.
- Neff, J.M. 1985. Polycyclic aromatic hydrocarbons. *In: Fundamentals of aquatic toxicology*, G.M. Rand and S.R. Petrocelli, pp. 416-454. Hemisphere Publishing, Washington, D.C.
- Newcombe, C. P., and D. D. MacDonald. 1991. "Effects of Suspended Sediments on Aquatic Ecosystems." *North American Journal of Fisheries Management* 11: 72-82.
- Nickelson, T.E., J. W. Nicholas, A.M. McGie, R.B. Lindsay, D.L. Bottom, R.J. Kaiser, and S.E. Jacobs. 1992. Status of anadromous salmonids in Oregon coastal basins. Unpublished manuscript. Oregon Department of Fish and Wildlife, Research and Development Section, Corvallis, and Ocean Salmon Management, Newport. 83 p.
- NMFS (National Marine Fisheries Service). 1996a. Supplemental report of the Biological Review Team on central California coast coho salmon. Memorandum from M. Schiewe to W. Stelle, dated 17 October, 1996, 4 p. Available from Environmental and Technical Services Division, National Marine Fisheries Service, 525 NE Oregon Street, Portland, Oregon 97232.
- NMFS (National Marine Fisheries Service). 1996b. Status review update for coho salmon from Washington, Oregon, and California. Draft document prepared by the West Coast Coho salmon Biological Review Team, 20 December 1996, 47 p. plus tables, figures and appendices.

- NMFS (National Marine Fisheries Service). 1996c. Fish Screen Criteria (revised February 16, 1995) and Addendum: Juvenile Fish Screen Criteria for Pump Intakes (May 9, 1996) guidelines and criteria for migrant fish passage facilities, and new pump intakes and existing inadequate pump intake screens. Hydropower Division, Portland, Oregon. 46 p. Available online at: <http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm>.
- NMFS (National Marine Fisheries Service). 1997. Status review update for coho salmon from the Oregon and Northern California coasts. West Coast coho salmon Biological Review Team, 28 Mar. 1997. 70 p. + appendices.
- NMFS (National Marine Fisheries Service). 1998a. Factors contributing to the decline of chinook salmon: an addendum to the 1996 West Coast steelhead factors for decline report. Protected Resource Division, National Marine Fisheries Service, Portland, Oregon. 70 p.
- NMFS (National Marine Fisheries Service). 1998b. Backpack Electrofishing Guidelines (December 1998). Protected Resources Division, Portland, Oregon. Available online at: <http://www.nwr.noaa.gov/1salmon/salmesa/pubs/electrog.pdf>.
- NMFS (National Marine Fisheries Service). 2001a. Status review update for Lower Columbia River Coho Salmon. West Coast coho salmon Biological Review Team, May 2001. 67 p.
- North, J. A., L. C. Burner, B. S. Cunningham, R. A. Farr, T. A. Friesen, J. C. Harrington, H. K. Takata, and D. L. Ward. 2002. Relationships Between Bank Treatment/Near Shore Development and Anadromous/Resident Fish in the Lower Willamette River. Annual Progress Report May 2000 - June 2001. Oregon Department of Fish and Wildlife. City of Portland-Bureau of Environmental Services. Portland, Oregon. February 2002.
- Peters, R. J., B. R. Missildine, and D. L. Low. 1998. Seasonal Fish Densities Near River Banks Treated with Various Stabilization Methods. US Fish and Wildlife Service, Lacey, Washington.
- OCSRI (Oregon Coastal Salmon Restoration Initiative). 1997. State of Oregon, Salem. March 10, 1997.
- Oregon Plan. 1997. Oregon Plan for Salmon and Watersheds (consisting of the Oregon Coastal Salmon Restoration Initiative, March 10, 1997 and as amended with the steelhead Supplement, December 1997). Governor's Natural Resources Office, State of Oregon, Salem.
- Oregon Trout, Native Fish Society, Oregon Council of Trout Unlimited. 2000. Petition to list lower Columbia River coho salmon (*Oncorhynchus kisutch*) as endangered pursuant to the Endangered Species Act of 1973 as amended. Petition to Secretary of Commerce, Washington D.C. (July 2000) 22 p.

- PFMC (Pacific Fishery Management Council), 1998a. Final Environmental Assessment/Regulatory Review for Amendment 11 to the Pacific Coast Groundfish Fishery Management Plan. October 1998.
- PFMC (Pacific Fishery Management Council), 1998b. The Coastal Pelagic Species Fishery Management Plan: Amendment 8. Portland, Oregon.
- PFMC (Pacific Fishery Management Council). 1999. Amendment 14 to the Pacific Coast Salmon Plan. Appendix A: Description and Identification of Essential Fish Habitat, Adverse Impacts and Recommended Conservation Measures for Salmon. Portland, Oregon.
- Redding, J. M., C. B. Schreck, and F. H. Everest. 1987. "Physiological Effects on Coho Salmon and Steelhead of Exposure to Suspended Solids." Transactions of the American Fisheries Society 116: 737-744.
- Reeves, G.H., F.H. Everest, and T.E. Nickelson. 1989. Identification of physical habitats limiting the production of coho salmon in western Oregon and Washington. US Forest Service PNW-GTR-245
- Sandercock, F.K. 1991. Life history of coho salmon (*Oncorhynchus kisutch*). Pages 395-446 In: Groot, C. and L. Margolis (editors). 1991. Pacific salmon life histories. University of British Columbia Press, Vancouver, British Columbia.
- Scannell, P.O. 1988. Effects of Elevated Sediment Levels from Placer Mining on Survival and Behavior of Immature Arctic Grayling. Alaska Cooperative Fishery Unit, University of Alaska. Unit Contribution 27.
- Schaffter, R. G., P. A. Jones, and J. G. Karlton. 1983. Sacramento River and Tributaries Bank Protection and Erosion Control Investigation Evaluation of Impacts on Fisheries. California Department of Fish and Game. US Army Corps of Engineers DACWO 5-80-C-0110. Sacramento, California. 1983.
- Schmetterling, D. A., C. G. Clancey, and T. M. Brandt. 2001. Effects of Riprap Bank Reinforcement on Stream Salmonids in the Western United States. Fisheries Vol. 26, No. 7 pp. 6-13.
- Servizi, J. A., and Martens, D. W. 1991. "Effects of Temperature, Season, and Fish Size on Acute Lethality of Suspended Sediments to Coho Salmon". Canadian Journal of Fisheries and Aquatic Sciences 49:1389-1395.
- Sigler, J. W., T. C. Bjornn, and F. H. Everest. 1984. "Effects of Chronic Turbidity on Density and Growth of Steelheads and Coho Salmon." Transactions of the American Fisheries Society 113: 142-150. 1984.

- Spence, B. C., G. A. Lomnický, R. M. Hughes, and R. P. Novitzki. 1996. An ecosystem approach to salmonid conservation. ManTech Environmental Research Services, Inc., Corvallis, Oregon, to National Marine Fisheries Service, Habitat Conservation Division, Portland, Oregon (Project TR-4501-96-6057).
- U.S. Census Bureau. 2004. State and County Quickfacts: Douglas County, Oregon. Available online at <http://quickfacts.census.gov/qfd/states/41/41033.html>
- Whitman, R.P., T.P. Quinn and E.L. Brannon. 1982. Influence of suspended volcanic ash on homing behavior of adult Chinook salmon. Trans. Am. Fish. Soc. 113:142-150.
- Weitkamp, L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. 1995. Status review of coho salmon from Washington, Oregon and California. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington.